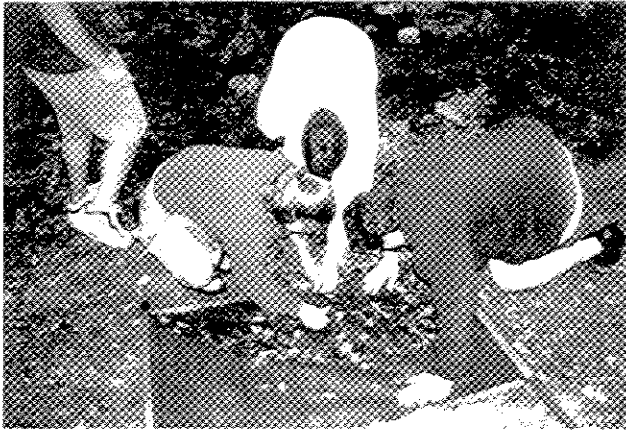


S T R E A M S



*Students Sifting for Microinvertebrates
Towson High School
Baltimore County Public Schools*



*Students Studying Health of Streams
Towson High School
Baltimore County Public Schools*

Case Study: Streams

At Towson High School in northern Baltimore County, the 11th and 12th graders are learning about and restoring a schoolyard stream environment. As the final project for the Chesapeake Bay Course (one semester/elective), students were assigned a small, three meter wide, riparian area to restore. Using the Save Our Streams publication, *A Citizen's Streambank Restoration Handbook* (page D-2, References), students assessed the stream, developed a restoration plan, then carried out the restoration. The 1997/98 school year was the first year of this project.

Funding for this stream restoration was provided by the Herring Run Watershed Association and the Baltimore County Forestry Board for trees and the Chesapeake Bay Trust for chemical kits.

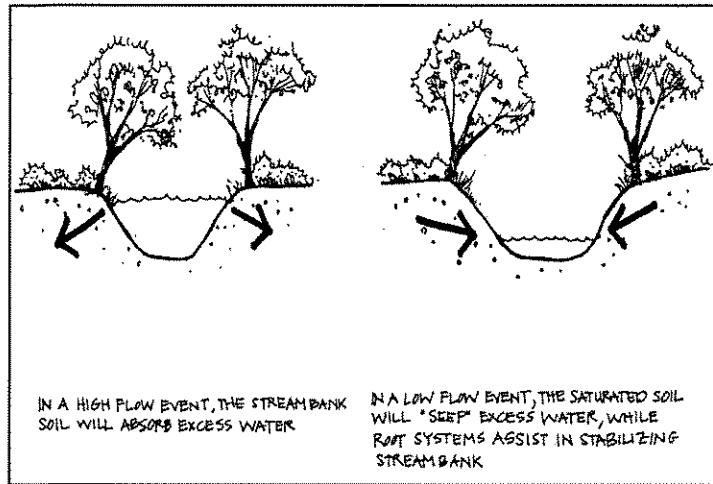
The teacher of the Chesapeake Bay course at Towson High School said, "One of the goals of this class is to teach students ways in which they can actually do something to help the health of the Bay. We go by the motto of 'Nobody made a greater mistake than he/she who did nothing because they could only do a little.' Along with the community newsletter distribution and the stream restoration, the students actually make a contribution to saving the Bay."

Environmental Enhancement

Stream ecosystems that flow on a school site provide many opportunities for students, faculty, and administrators to learn about local water quality and wildlife habitats. These unique ecosystems are the school's direct link to the Chesapeake Bay and Maryland's efforts to restore this endangered estuary. As stewards of a school site stream environment, students, teachers, maintenance, and administrative staff have an opportunity to learn about and understand how streams work, hopefully becoming active in projects that will protect and restore these fragile ecosystems so vital to the Chesapeake Bay.

Ways in Which Healthy Stream Ecosystems on School Sites Help the Environment

- Provide protected areas along stream banks, for trees and wetland plants. These areas known as, *riparian buffer zones* should be not less than 25 feet in width.
- Wildlife use forested buffer strips to travel to and from feeding areas, and for seasonal migrations. These corridors are located along streams because stream buffers provide shelter and protection from predators and human disturbances.



Streambank Vegetation Serves Many Purposes
(Izaak Walton League of America)

Figure 8

- Riparian buffer areas provide opportunities for students to design and implement habitat enhancement projects such as bird, squirrel, and bat boxes, as well as tree and shrub plantings to attract wildlife.
- Stream buffers can filter stormwater runoff from athletic fields, tennis courts and buildings.
- By planting trees within the riparian buffer, students will be actively participating in a new statewide mandate to plant 2,010 miles of streamside buffer strips by the year 2010. The Maryland Department of Natural Resources Forest Service can provide advice and trees for many planting projects on public land. This effort will help Maryland meet a very important goal to improve local water quality and ultimately restore the vitality of the Chesapeake Bay.

Contribution to Educational Programs

A student's educational program from elementary age through high school can be enhanced by learning outdoors. The opportunities to apply lessons to local environments and environmental issues, specifically using elements of a local stream system are limited only by the imagination of the teachers.

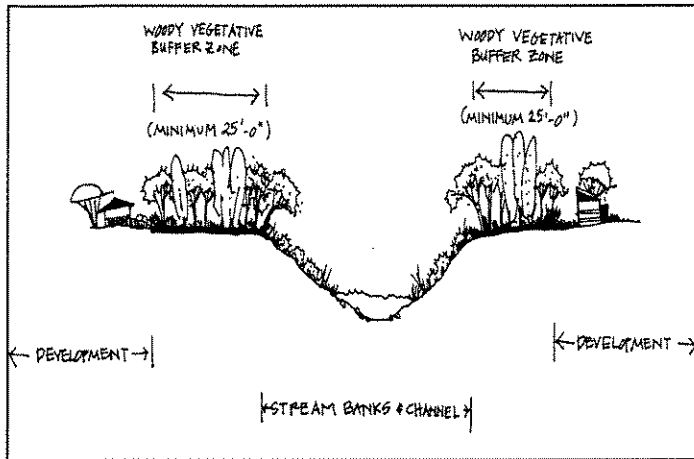
Having a stream ecosystem and its associated riparian buffer on or near campus is a valuable opportunity for teachers and students to get involved with global issues and efforts to improve their environment. Stream ecosystems are an excellent resource to:

- Begin investigations in the fields of physics, engineering, geology, and biology. For example, stream velocity and channel sinuosity studies can help students learn real life applications for mathematical studies.
- Conduct research on fish species and aquatic habitats.
- Develop and implement habitat enhancement projects that could provide for student service learning credits and valuable lessons regarding environmental stewardship.
- Provide inspiration for students writing and art expressions about their local community or a natural ecosystem.

Planning, Design, and Construction

As the appointed stewards of public land, school facility planners, and administrators are charged with an enormous responsibility to consider all phases of a construction operation and how a project will affect local waterways. Most of these considerations are directed by state and federal laws, but many design and construction decisions and activities can be geared toward how to better protect a school site stream, or in the case of a stormwater retrofit, improve the ecosystem for future generations of students.

Infiltration is vitally important for stream protection. The dynamic, yet stable geometry of stream channels evolved in mostly forested watersheds where 85% of runoff entered streams slowly through groundwater seepage and 15% from overland flow. In watersheds where a significant amount of forest is cleared, the percentages are reversed. Overland flow translates into large volumes and increased velocities causing streambank erosion that smothers aquatic life and fills navigation channels with silt.



Riparian Zone Vegetation
(Izaak Walton League of America)

Figure 9

Through planning of construction projects, consideration should be given to stream protection beyond mandated guidelines. Every opportunity should be made to promote infiltration of rainwater. This generally means reducing the quantity of stormwater from a site that is directed to a basin. A variety of techniques used at a smaller scale throughout a site can greatly aid infiltration while significantly reduce or eliminate the need for stormwater management basins. Some of the techniques include bioretention (rain gardens), open grass swales, sand filters, wetlands and porous pavement. Many resources are available on this topic. A local group, the Center for Watershed Protection, has two excellent design manuals: Design of Stormwater Filtering Systems and Site Planning for Urban Stream Protection (page D-2, References).

There are five different physiographic regions in the state of Maryland. They are: *coastal plain*, *piedmont*, *blue ridge*, *ridge and valley*, and the *Appalachian plateau*. These areas are defined by distinctive geographical features. Each of these regions have specific types of watershed characteristics and runoff patterns with regard to stream ecosystems. It is important to know in which type of physiographic region your stream is located. This information will lead to a better understanding of drainage patterns on and

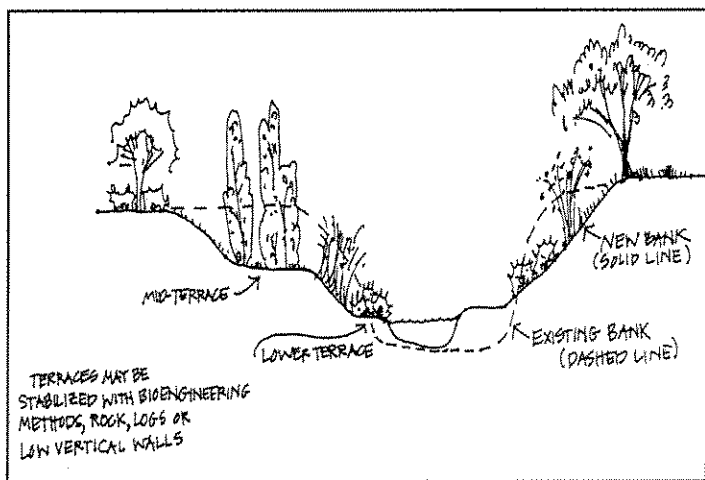
around the school site and will help school staff understand more about the aquatic species and habitats of the stream.

When planning for school facilities, it is imperative that certain school operations be located away from stream areas and that adequate stormwater considerations be addressed so that these operations will not affect the water quality and buffer stability of the riparian areas.

Stormwater Runoff Areas and Pollution Sources

- school maintenance areas
- cafeteria and kitchen
- athletic fields
- green houses
- basketball and tennis courts
- parking facilities
- career education facilities for programs such as automotive services, carpentry, small engines, and welding areas

Any construction project, whether it is new construction or renovation of an existing facility, which disturbs 5,000 square feet of soil will require an approved sediment and erosion control plan. Check with the appropriate county agency for details. Construction projects should be designed to avoid disruption of stream buffers and 100-year flood plains. If



Stabilize Slope by Creating Terraced Banks
(Izaak Walton League of America)

Figure 10

construction in the floodplain or 100-year floodplain is unavoidable, as in a road or trail which crosses a stream, permits will be required from Federal and/or State regulatory agencies. Contact the Maryland Department of the Environment to determine specific requirements.

One relatively new and interesting stream rehabilitation effort emerging on the environmental restoration scene is the concept of "daylighting". This is an attempt to take long buried stream hydrologic systems and restore them to free flowing uncovered environments. Although costly, stream "daylighting" is a worthwhile project. Many streams that used to flow through neighborhoods were encased in concrete culvert type structures years ago to facilitate the building of roads, communities, schools, and even athletic fields. The idea was that by burying the stream, the developers could better control stormwater runoff and erosion. With recognition of the value of having an ecologically viable stream in a community, restoration efforts are increasing that remove culvert structures and restore a stream's natural channel and flow. For more information about stream "daylighting" call the Coalition To Restore Urban Waters coordinator at the Izaak Walton League of America (1-800-BUG-IWLA).

Long Term Maintenance

Riparian buffers should require little maintenance if they are not excessively disturbed. However, it may be necessary to do periodic planting if school activities result in damage to vegetation. If exotic invasive vegetation (e.g. Japanese honeysuckle, oriental bittersweet) is overwhelming native vegetation, a control program may be necessary.

Trails or roads which provide access to or cross streams should be checked on a regular basis to ensure that erosion is not occurring.

Stormwater management facilities must be maintained on a regular basis to ensure that they are functioning properly and are in compliance with applicable statutes, such as the Maryland Dam Safety Regulations. Areas downhill of all school facilities, including athletic fields, should be checked periodically to ensure that runoff is not causing erosion.

Student Participation

Student participation can take many forms as suggested by the following examples:

- Site rehabilitation concept and design--identification of problems and design considerations.
- Organize a group project to remove stream barriers to fish migrations (be sure to call a local stream ecologist before removing instream barriers such as tree limbs--they could be providing important aquatic habitat for insects and fish).
- A stream clean-up is an excellent way to improve not only water quality but the aesthetic quality of a stream environment and it encourages stream neighbors to do their part to keep out trash.
- Buffer planting--all phases from design to implementation.
- Stormwater retrofit--students working with engineers and landscape architects.
- Public education campaign--write an article for the school newsletter, contact the local paper or submit a letter to the editor, organize and host an education forum for the neighborhoods along the stream, produce a public service announcement for the local cable TV station.
- Grant writing--students can write a grant to help fund monitoring equipment and restoration materials.
- Learning about the County/Municipal permit processes.
- Fundraiser--have some fun--throw a party to raise awareness and money to support the project.

Safety

All activities outdoors involving student groups should follow precautions to ensure the safety of those working in or along waterways.

Stormwater-flooding - Throughout Maryland's Piedmont and coastal plain regions, flash flooding during and after severe rain showers can be a threat to human safety in and along stream corridors. In highly impervious urban areas this situation is more prevalent

and should be identified to all teachers and student groups involved with stream studies. Most radio and TV weather reports will include flash flood alerts. Teachers and students should cancel all stream related activities if the local weather forecast includes a flash flood alert.

Access-Erosion - With all outdoor activities, footing on uneven ground can be hazardous. Stream banks are dynamic environments and care must be taken to identify safe access areas that do not require students to climb down steep or highly eroded banks. Access areas should be relocated over time if large numbers of students are using them. This will lessen the impact to the bank and ensure the safety of the students.

Remote Study Areas - Stream corridors are usually heavily wooded and located away from school buildings. Students need to stay with a group or a partner during all stream related activities. Care should be taken walking in streams because of algae covered rocks, soft sediment, or submerged objects. Students should wear only shoes that tie on or boots - sandals are not recommended. A cellular phone or hand held two-way radio should be carried by a teacher to contact the school in the event of an emergency.

Pollution - Because streams are located at the lowest point in watersheds, trash and woody debris are constantly being washed into them during storm events. In addition, the remoteness of these environments can attract illegal dumping of trash and yard waste. It is imperative that teachers scout a stream site before student trips. Such hazards could include hypodermic needles, broken glass or drums with unidentifiable substances.

Water pollution that is hard to identify such as an oil or chemical spill can be dangerous to human health. Before students enter a stream, the teacher or group should scan the water surface. If the water is cloudy or has an unusual color or odor do not allow the stream water to come in contact with the skin, mouth or eyes until it has been checked out by a local water management authority. It is imperative that a student or teacher report all suspicious water pollution. The Maryland Department of The Environment has a water pollution hotline; (410) 974-3551, and so do many local government agencies and public works departments.

Regulatory Requirements

Streams are regulated as wetlands under section 404 of the Clean Water Act. Additional regulations may vary by location, water use classification, and county. Check with the Maryland Department of the Environment and appropriate county agencies to determine which regulations apply.

References

Maryland Department of the Environment. 1994. Maryland Standards and Specifications for Soil Erosion and Sediment Control.

Maryland Department of the Environment. 1987. Design Procedures for Stormwater Management Extended Detention Structures.

Maryland Department of the Environment. Draft Maryland Stormwater Design Manual. Available on MDE website, <http://www.mde.state.md.us>

USDA, Soil Conservation Service. 1986. Urban Hydrology for Small Watersheds (Technical Release Number 55), Second Ed.

USDA, Soil Conservation Service. 1982. Ponds-- Planning, Design, Construction. SCS Agriculture Handbook No. 590.

Table 7